



Center for Military Medicine *"SOTLK"*



CENTRE FOR MILITARY MEDICINE
JUHA-PETRI RUOHOLA



Mission statement of SOTLK

- **Center for Military Medicine**
 - is responsible for organising the Defence Forces' primary health care and specialized health care services and medical logistics
 - serves as a know-how, training and research center for military medicine, field medicine, disaster medicine and medical CB defence, as well as environmental health
 - produces the medical service know-how necessary for maintaining the service safety of the Army, Navy and Air Force, as well as the fitness for military service and functional ability of soldiers
 - serves as a national Aeromedical Center and Diving Medicine Center





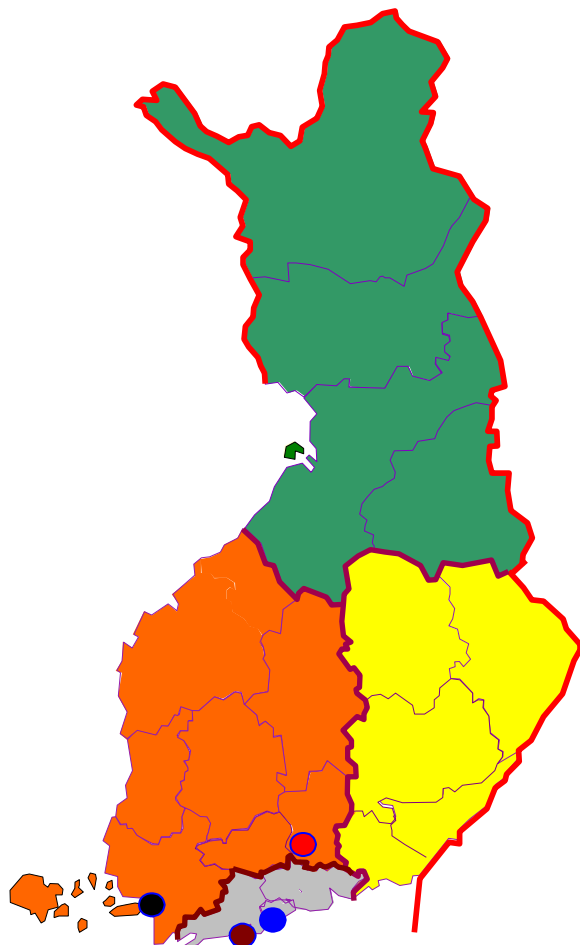
Research and Development Division

- Aeromedical Center
- Diving Medical Center
- Field Medicine Center
- CB Defence and Environmental Health Center





Center for Military Medicine, Garrison Health Center



Turku garrison HC

Center for Military Medicine
and Field Medicine Center

Aeromedical Center
and CB Defence and
Environmental Health Center

Diving Medicine Center

CENTRE FOR MILITARY MEDICINE
JUHA-PETRI RUOHOLA

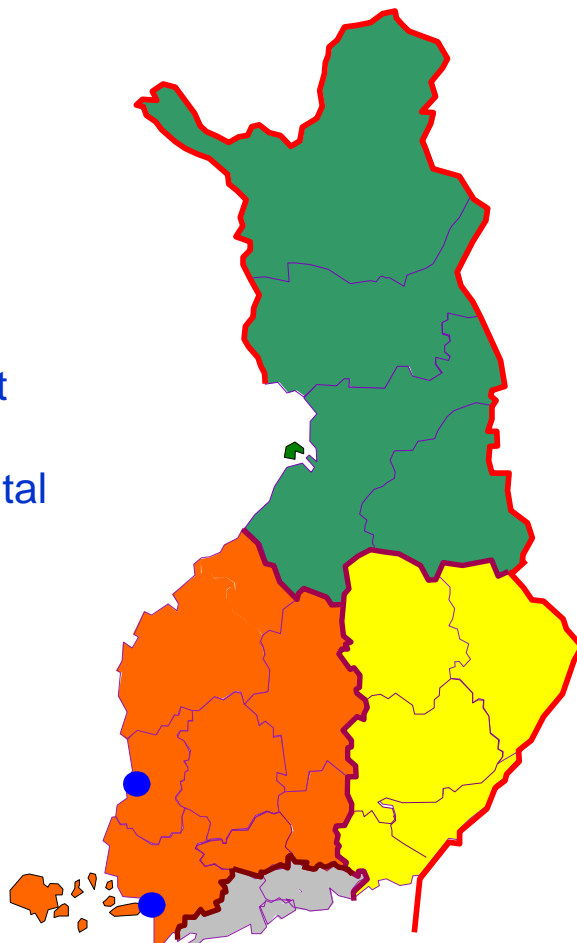




Strategic partners in specialized health care and medical material service

Satakunta Hospital District

South-West Finland Hospital
District



CENTRE FOR MILITARY MEDICINE
JUHA-PETRI RUOHOLA



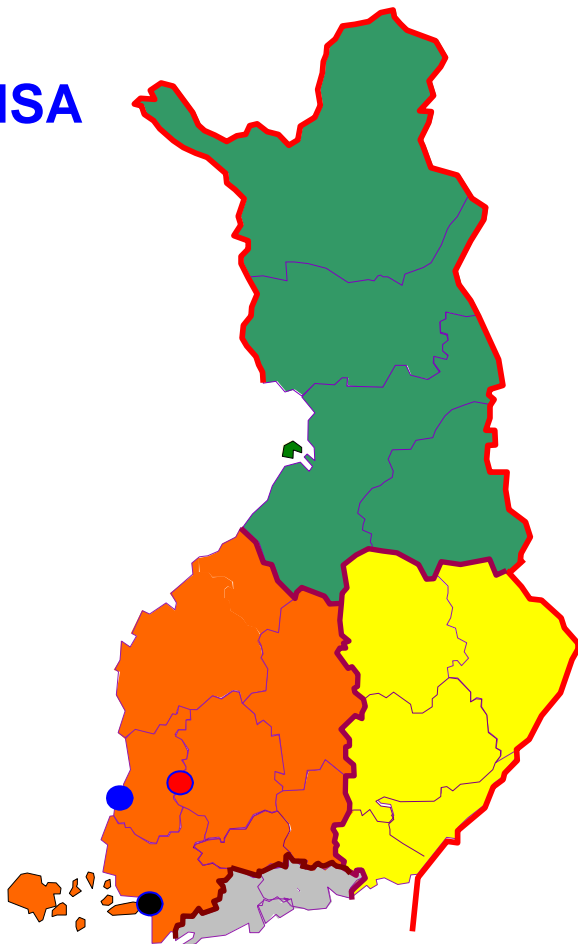
Satakunta Hospital District

SATAKUNNAN KANSA

- local newspaper
- since the year 1873

ARTICLE in July 2009

"IT MAKES SENSE TO
LIVE IN **LUVIA** RATHER
THAN IN **KIIKOINEN**"



CENTRE FOR MILITARY MEDICINE
JUHA-PETRI RUOHOLA





Vitamin D and public health

- Bone metabolism
- Cardiovascular and pulmonary diseases
- Cancer
- MS-disease
- Fibromyalgia
- Rheumatic diseases





Vitamin D and public health

- Metabolic syndrome
- Diabetes
- Asthma
- Infections
- Parkinson's disease
- Acts also like hormone





Vitamin D is produced in the skin induced by ultraviolet B radiation





Vitamin D also occurs naturally in foods





Latitude between 60 and 70 N

In northern climates, diet is the most important source of vitamin D in the winter months, because exposure to sunlight is limited

In Finland vitamin D insufficiency is common in all age groups between October and March





CENTRE FOR MILITARY MEDICINE
JUHA-PETRI RUOHOLA



Measurement

Reasonable way to determine vitamin D status, is to measure the major circulating form of hormone – the serum concentration of 25(OH)D





Vitamin D status

There is a scientific consensus that
vitamin D insufficiency is reached at
25(OH)D concentrations < 80 nmol/L
and vitamin D desufficiency at
25(OH)D concentrations < 40 nmol/L





As part of the national public health policy

- Since February 2003 in Finland by recommendation of the Finnish Ministry of Social Affairs and Health, vitamin D has been added to commercially produced milk (0.5 $\mu\text{g}/100\text{ ml}$) and certain margarines (10 $\mu\text{g}/100\text{ g}$)





Vitamin D fortification

- We studied the effects of this national policy on vitamin D fortification in randomly chosen young Finnish men
- Serum 25-(OH)D concentrations were determined in January 2003 (n=96) and in January 2004 (n=100), nearly 1 year after national vitamin D fortification had started





Vitamin D fortification

- In this study serum concentrations below 40 nmol/l were regarded as indicating vitamin D insufficiency
- Daily milk and margarine consumptions were estimated to 8 dl and 30 g, respectively





Results

- The mean serum 25-(OH)D concentrations during the wintertime increased by 50% after implementation of the vitamin D fortification of products
- After fortification mean serum 25-(OH)D level changed from 33.5 ± 9.2 nmol/l (January 2003) to 50.2 ± 20.3 nmol/l (January 2004) ($p < 0.001$)





Results

- Correspondingly, the prevalence of vitamin D insufficiency (<40 nmol/l) was decreased by 50%
- Vitamin D insufficiency (< 40 nmol/l) was found in 78.1% (January 2003) and 35.0% (January 2004) ($p<0.001$)





Comment

- Our results demonstrated that national vitamin D fortification substantially improved the vitamin D status of young Finnish men
- Still, 1/3 remained vitamin D insufficient, suggesting the need for vitamin D supplementation during wintertime





Vitamin D and Bone Stress Fractures





Vitamin D and Bone Stress Fractures

- The effects of vitamin D in regulating bone mineralization and health are well documented
- main function is in calcium and phosphorous homeostasis
- Low vitamin D level may predict rickets, osteomalacia or osteoporosis





Vitamin D and Bone Stress Fractures

- Fatigue bone stress fracture is one of the most frequently seen types of overuse injuries in athletes and military recruits
- We measured serum 25OHD concentration in a population sample of military recruits to determine if vitamin D is a predisposing factor for fatigue bone stress fracture





Materials and methods

For 90 days 800 randomly selected, healthy Finnish military recruits (mean age 19) were prospectively followed in homogenous circumstances, 756 subjects completed the study





Materials and methods

- Blood for serum 25OHD concentration was drawn at entry into military service (early July). The subjects were followed to identify possible bone stress injuries, which were confirmed by plain radiographic imaging or MRI examination





Concentration of 25OHD, nmol/l

Median (Range)

With stress fracture (n=22)	Without stress fracture (n=734)	Significance (Test)
64.3 (40.1-159.0)	76.2 (25.2-259.0)	0.017 (M-W)





Risk factor

Muscle strength	0.025 (T)
Cooper/12-minute run test	0.007 (T)
Daily smoking	0.85 (P)
Age	0.27 (T)
BMI	0.41 (T)
Height	0.15 (T)
Weight	0.70 (T)





In the multivariate regression

model, which adjusted all previous variables, the risk of stress fracture with serum 25OHD levels below the median was 3.6 times the risk of those with concentrations exceeding the median level. The result of muscle strength or 12-min running test were not significantly associated with stress fractures in the multivariate model





25OHD (nmol/l)

Number (Frequency)

< median	18 (81.8%)	362 (49.3%)	0.002 (P)
≥median (75.8 nmol/l)	4 (18.2%)	372 (50.7%)	
Missing N	0	0	





Conclusions

A lower level of serum 25OHD concentration seems to be a generally predisposing element for bone stress fractures.

Considering the obvious need of additional vitamin D in prevention of stress fractures, the effects of vitamin D fortification of foods and supplementation were subjects of interest for future research





Vitamin D and Respiratory Infections





Vitamin D and Respiratory Infections

- The action of vitamin D in antibacterial responses has been under studies
- We aimed to explore whether an association exists between vitamin D insufficiency and acute respiratory tract infection in young Finnish men
- For the regression analysis serum 25(OH)D concentrations categorized as <40 nmol/l and ≥ 40 nmol/L





Materials and methods

- Subjects: same 800 healthy military recruits, 652 completed the study (some subjects moved to officer school etc after three months of service)
- Serum 25OHD concentration at entry
- Follow-up time: 6 months
- Number of days of absence from duty due to respiratory infection were counted (physician-diagnosed)





Results

- Serum 25(OH)D concentrations <40 nmol/L were found in 3,6% of the subjects (mean 80.2 nmol/L)
- These subjects ($n=24$) had significantly ($P = 0.004$) more days of absence from duty than control subjects





Results

- There also was a significant association between serum 25(OH)D concentrations and both, the amount of pre-service physical exercise and smoking, but these did not confound the main results





Limitation of the study

Because only one vitamin D measurement was obtained, the persistence of differences in vitamin D status during the study was not evaluated (vs 6 months follow-up time)

”seasonal stimulus -> seasonal influenza?”





Conclusion

- The present study demonstrated a significant negative association between serum 25(OH)D levels and the number of days absent from daily duty due to acute respiratory tract infection
- Supplementation?





Supplementation





Supplementation

- The next study was a double-blinded, placebo-controlled randomized trial whose primary outcome was to determine whether vitamin D supplementation decreases the number of days absent from duty due to acute respiratory tract infection





Materials and methods

- Subjects: 164 voluntary young healthy Finnish men (18-28 years) undergoing compulsory military training as conscripts in an infantry unit
- The subjects represented the general conscript population of the Finnish Defence Forces





Materials and methods

- Exclusion criteria were the use of supplementary vitamin D, multivitamins, and cod liver oil
- The intervention group received 400 IU (n=80) vitamin D daily
- The control group (n=84) received placebo





Materials and methods

- Following the recommendation for vitamin D use by the Finnish Ministry of Social Affairs and Health, 400 IU of vitamin D daily was used in the study (400 IU = 10 µg)

(400 IU is also a normal level in multivitamin products)





Materials and methods

- The trial was performed from October to March
- After randomization, blood samples were drawn from 73 subjects at the beginning of the study in October 2005 and again from 108 subjects in March 2006 to determine the serum 25(OH)D concentrations





Results

- At the beginning of the study, there was no difference in serum 25(OH)D concentrations between the intervention (78.7 ± 14.9 nmol/L, n=29) and placebo (74.4 ± 20.8 nmol/L, n=44) groups (p=0.35)





Results

- In March 2006, after daily supplementation with 400 IU vitamin D or placebo for 6 months, the mean serum 25(OH)D concentrations were 71.6 ± 22.9 nmol/L (n=58) in the intervention group and 51.3 ± 15.5 nmol/L (n=50) in the placebo group ($p < 0.001$)





Results

- However, the number of days absent from duty due to respiratory tract infection, did not differ between groups
- Nevertheless, the proportion of men remaining healthy throughout the 6-month study period was greater in the intervention group (51.3%, n=41) than in the placebo group (35.7%, n=30, $p=0.045$)





Discussion

- The present placebo-controlled double-blinded study of 164 young Finnish men provides some evidence for a preventive effect of vitamin D supplementation against respiratory tract infection
- but





Discussion

- The primary end-point (number of days absent from duty) did not differ significantly between groups, and an effect emerged only in the secondary outcome measures
- The study population comprised too small -> the power of the study was limited – however the homogeneity of study setting and population was a strength





Discussion

- The results of the study indicated that additional supplementation with 400 IU/d of vitamin D is not sufficient to maintain an adequate vitamin D level throughout the wintertime
- Based on the average consumption of milk and margarine in the Finnish Defence Forces, these young men typically receive 7 µg of vitamin D daily from vitamin D-fortified products





Recommendations for vitamin D use in Finland (10 µg = 400 IU)

children < 2 years - 10 µg

children > 2 years - 7,5 µg

adults < 60 years - 7,5 µg

adults > 60 years - 20 µg

(last one just recently, in March 2010, increased from 10 µg by Finnish National Nutrition Council)





Recommendations for vitamin D use in Finland

- The Finnish Nutrition Council is now also recommending that vitamin D levels in fluid milks and margarine products be increased (actually doubled) to ensure higher intake of the vitamin

(0.5 μg /100 ml in milk and 10 μg /100 g in margarines since 2003)





> 17 µg?

- The results of the study indicated that additional supplementation with 400 IU/d of vitamin D is not sufficient to maintain an adequate vitamin D level throughout the wintertime
- Based on the average consumption of milk and margarine in the Finnish Defence Forces, these young men typically receive 7 µg of vitamin D daily from vitamin D-fortified products





Discussion

- We need
 - more controlled trials with higher doses and larger populations to explore the effects of vitamin D (supplementation)
 - more vitamin D



Thank You!

